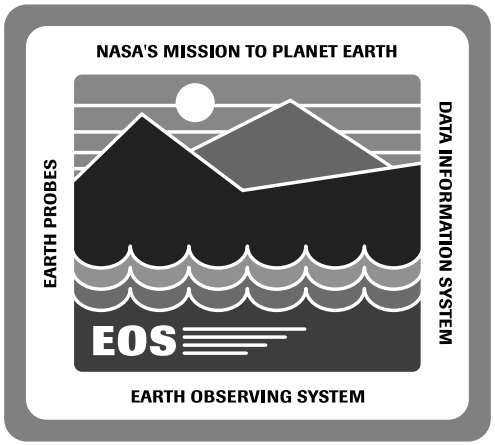


FOS Network Architecture

Dean Moore

16 October 1995

FOS CDR Roadmap

FOS CDR Overview
- FOS CDR goals
- Driving requirements

Engineering Activities
- Activities since PDR
- FOS team approach

System Architecture
- Overview
- Features

IST
- Capabilities
- Plans

Hardware Design
- Computers
- Peripherals

FOS Infrastructure
- Mgt Services
- Comm Services

Segment Scenarios
- End-to-End Flow
- Subsystem Interfaces
- Building block linkage

Subsystem Design
- Detailed design
- FOS functions/tools
- Subsystem design features

RMA
- RMA allocation
- FMEA/CIL

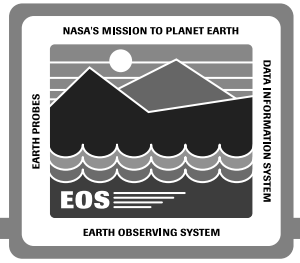
Operations Overview
- EOC facilities
- FOT positions

Operational Scenarios
- End-to-end flow
- Operations perspective
- FOT tool usage

Development
- Release Plan
- Development approach

Testing
- Test approach
- Test organization

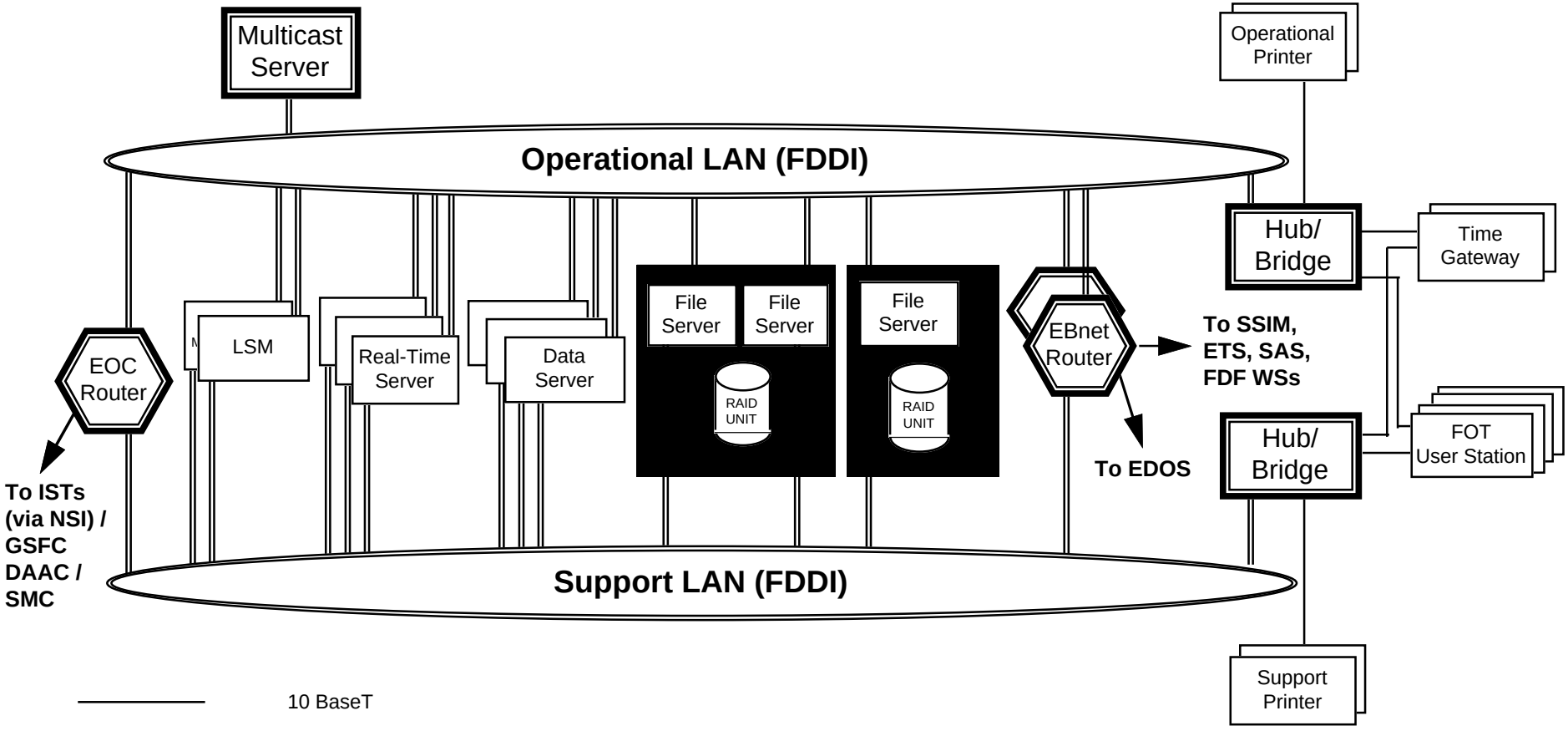
EOC LAN Design



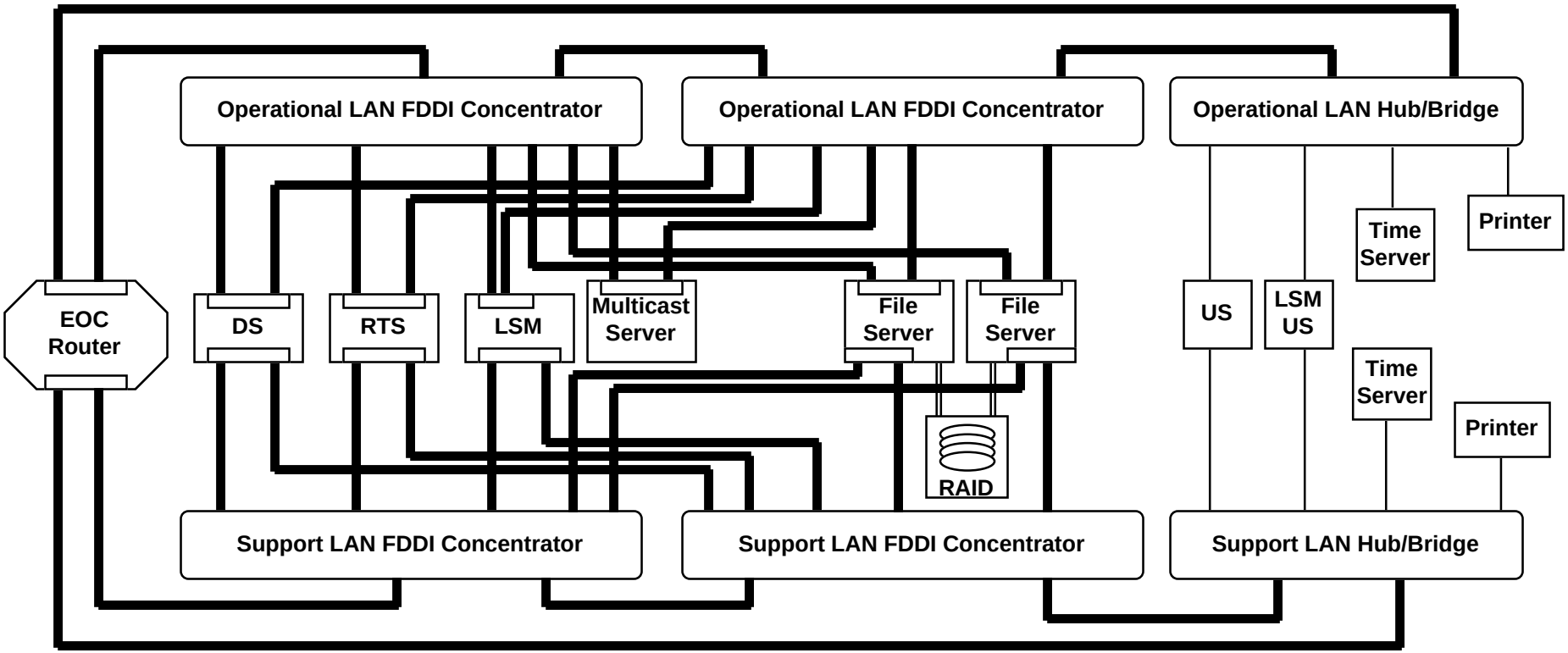
Design utilizes separate FDDI LANs for the Operational and Support Nets

- **Real-Time Server, Data Server, and Data Storage Unit attached to FDDI**
- **User Stations attached to dedicated Ethernet segments**
- **Hosts attached to both Operational Net and Support Net**
- **FDDI Network completely redundant**
  - **All hosts dual-homed to two separate concentrators**
  - **No single point of failure for real-time functions**

EOC LAN Design: Logical Connectivity



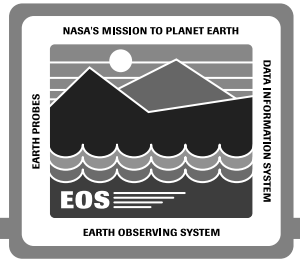
EOC LAN Design: Physical Connectivity



Note: Some devices, such as EBnet routers, not shown for clarity

FDDI Cable
Ethernet Cable
SCSI-2 Cable

EOC Network Hardware



Implementation employs "stackable" hubs and concentrators

- **Easy to configure and replace**
- **Simple hardware and software features increase uptime**

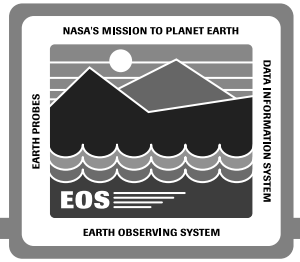
FDDI Concentrator

- **Bay Networks System 2000 - Model 2914-04**
- **Provides 12 FDDI "M" ports plus 1 FDDI A/B port**

FDDI-to-Ethernet Hub

- **Cabletron ESX-1320 with BRIM-F6 module**
- **Provides 12 switched Ethernet ports plus 1 FDDI A/B port**

Design Benefits



100 Mbps FDDI backbone provides plenty of bandwidth to handle future growth

Switched Ethernet provides each User Station with its own dedicated bandwidth not shared by other User Stations

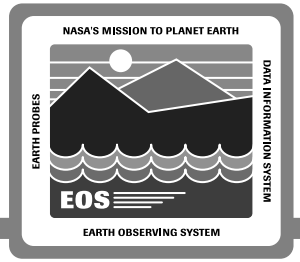
Separate Operational and Support LANs provide efficient network utilization by segregating traffic

Attaching devices to both the Operational and Support LANs allows devices to switch function without reconfiguring hardware (switch-over accomplished totally in software)

Advantages of Hub Implementation

- **Allows hosts to be added without disrupting network operation**
- **Provides central monitoring and troubleshooting point**
- **Hubs “chained” together to allow expansion**

FOS IP Multicasting



Benefits:

- **Reduces network and processor loads**
- **Provides simplified fault recovery**
- **Reduces latency in receipt of real-time data**

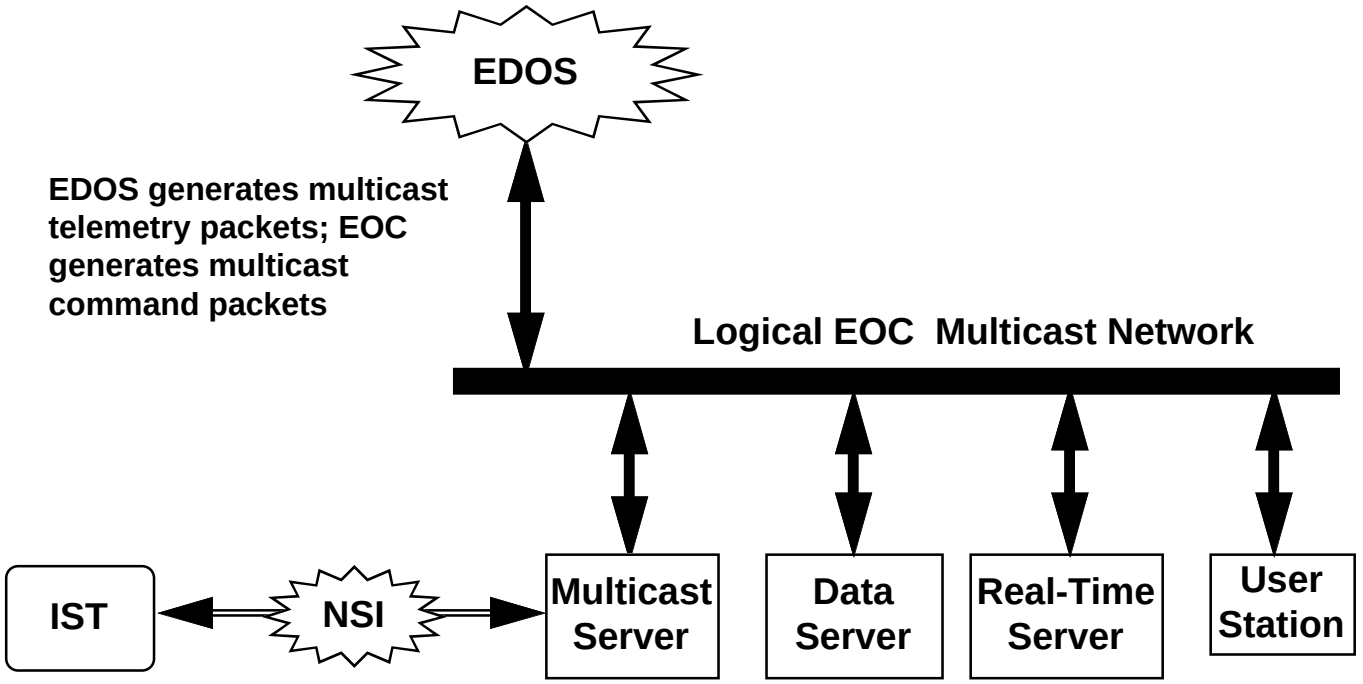
Multicast used

- **For telemetry from EDOS and commands to EDOS**
- **For shared replay and event messages within EOC**

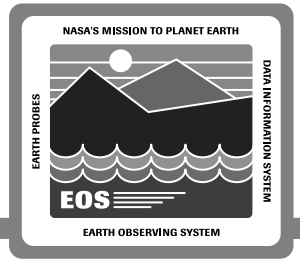
Communication to ISTs via “regular” IP unicast

- **Multicast Server at EOC converts multicast packets into unicast packets and forwards them to the ISTs**
  - **Allows ISTs to be “part of” multicast session**
  - **Transparent to IST user (IST simply joins “string”)**

FOS Multicasting Topology



EOC-IST Networking

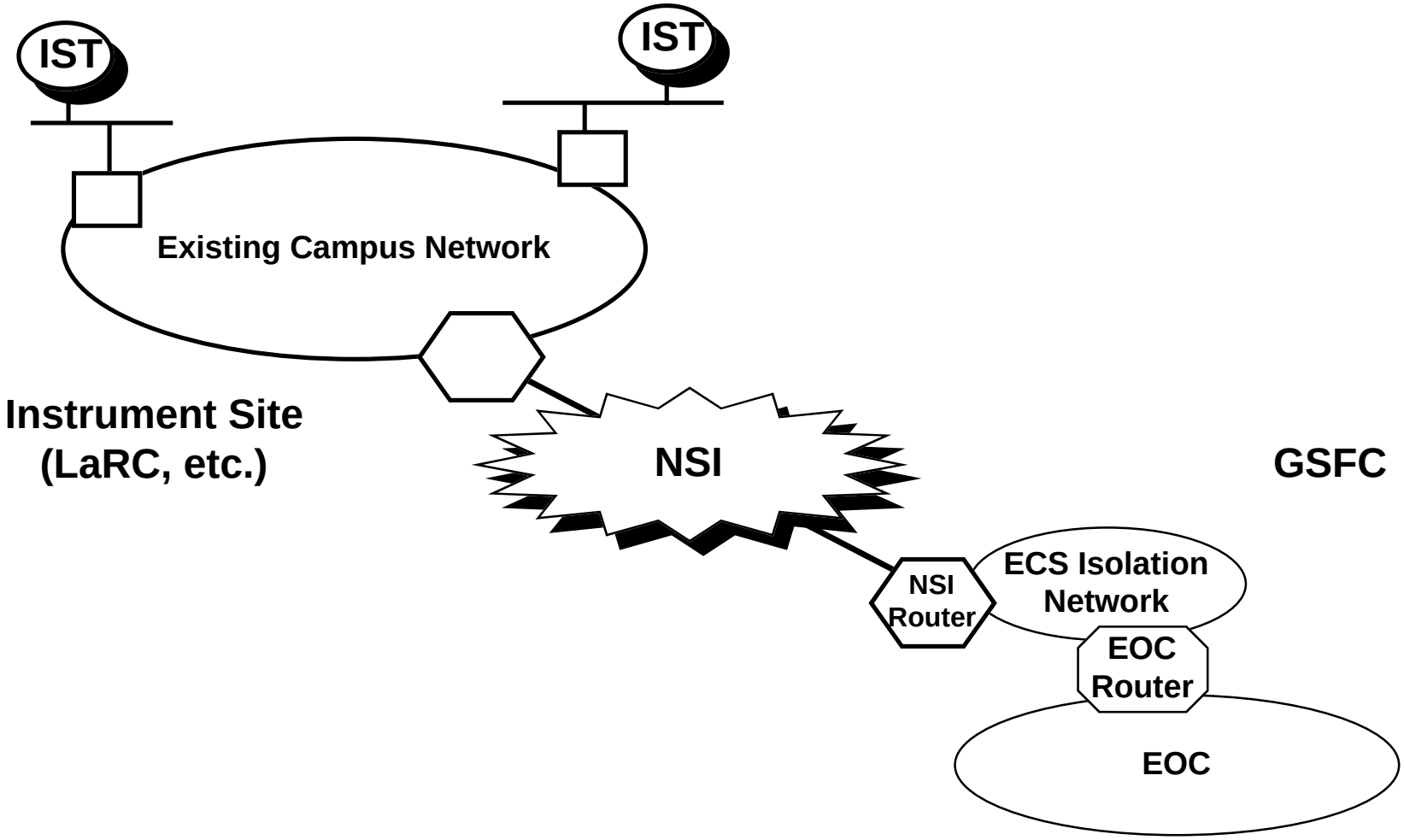


NASA Science Internet (NSI) will provide connectivity to ISTs (in conjunction with existing IST-site network facilities)

FOS working with ESDIS, NSI, and AM-1 Instrument Team to specify performance requirements

- **FTP Throughput for 1 MB file 50/90/99 percent of time**
  - **<16 sec 50% (~512kbps); <32 sec 90% (~256kbps); <64 sec 99%**
- **Round-trip Latency for interactive sessions 50/90/99 percent of time**
  - **<500 ms 50%; 1 sec 90%; 2 sec 99%**
- **Jitter for real-time monitoring 50/90/99 percent of time**
  - **<1 sec 50%; <2 sec 90%; <5 sec 99%**

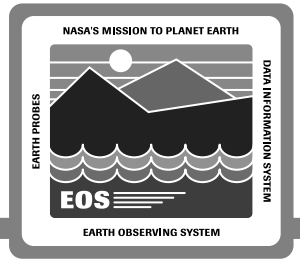
Generic IST Network Connectivity



FOS Security Architecture

Security Service	Implementation
Authentication • Passwords do not appear on net	DCE-based Kerberos encryption
Authorization and Access Control • Integrated with Authentication • Network Layer • Application layer	DCE Access Control Lists (ACLs) and Router Firewalls at EOC
Data Integrity • Encrypted checksums (prevents intentional tampering and unintentional corruption during transit)	COTS encryption software, KFTP

EOC Network Security



FOS Security Architecture briefed to EOSDIS Security Working Group in April 1995

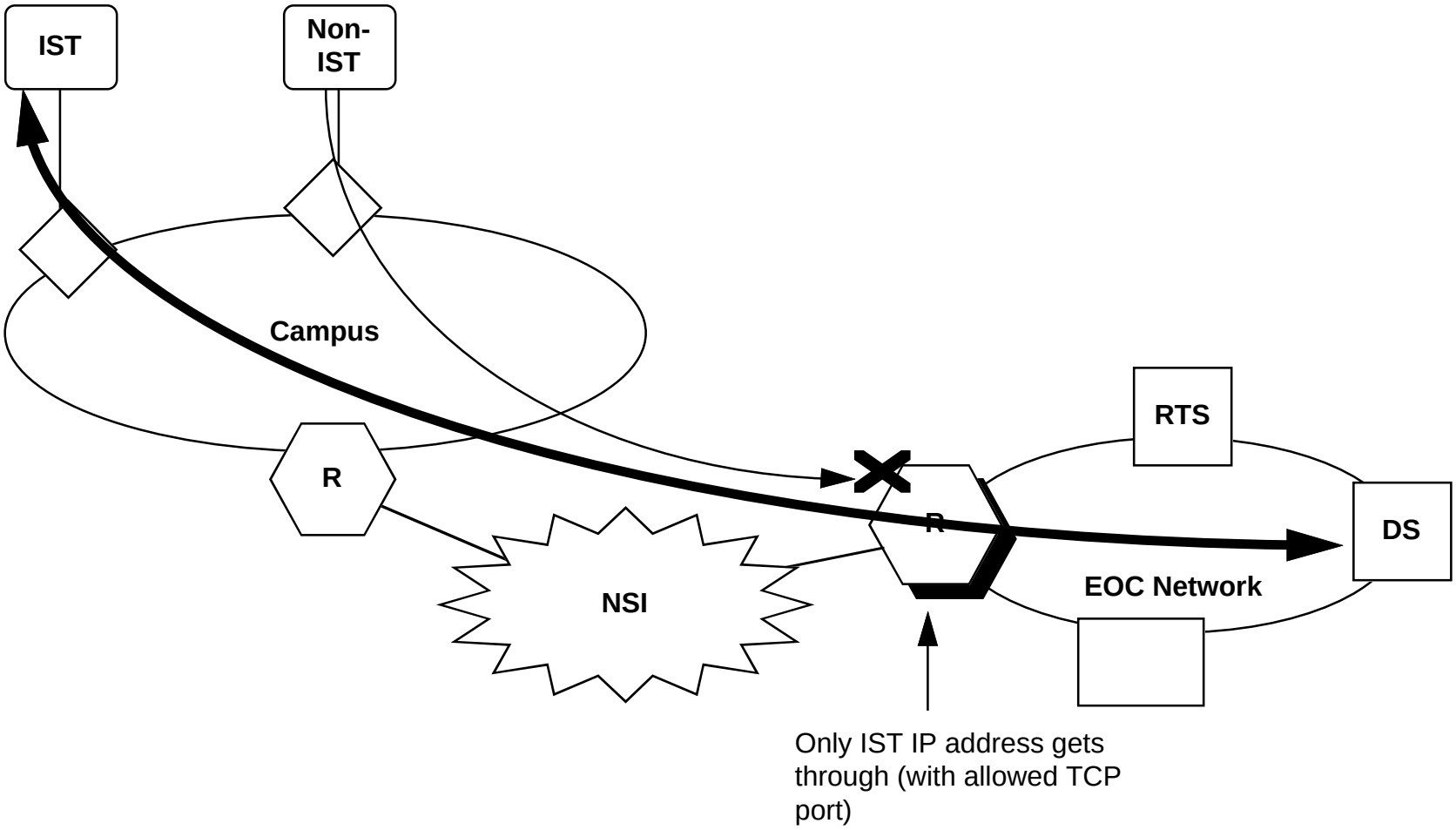
Only very limited groups allowed network access into EOC

- **ISTs**
- **GSFC DAAC (for archival and retrieval)**
- **SMC (for management information)**

Network security implemented via filters at EOC router

- **IP filters specify individual hosts allow into EOC**
  - **Includes each IST and the GSFC DAAC archival hosts**
- **TCP filters specify what applications are admissible, e.g.**
  - **No telnet or rlogin**

EOC Security: Router Filtering



EOC Security: Spoofing Example